Project No. 项目编号	BMTXW240020S0-AS
Customer 客户名称	
Module No. 客户型号	
Product type 产品内容	LCD+Touch Module TFT：240 *3RGB*320Dots 2.4”TFT LCD

客户确认Customer Approval	
项目负责人Project Manager	
品质主管Director of Quality	
采购工程师Purchasing Engineer	

CONTENTS

1. Document revision history :

DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
A	2017.05.25	First Release.	刘高	

2. General Description

- 2.4”(diagonal), 240 x3 RGB x320dots, 262K colors, Transmissive, TFT LCD+Touch module.
- Viewing Direction: 6 O’clock
- **Driving IC: ST7789V**
- **Touch IC: FT6236U**
- RGB Interface
- Logic voltage: 2.8V (typ.).
- With touch panel .

3. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter		Specifications	Unit
主屏 Color TFT 240 x3 RGB x320	LCM Outline dimensions	42.72(W) x60.26(H) x 2.11(D)	mm
	TP Outline dimensions	46.72(W) x65.86(H) x0.95(D)	mm
	TP view area	37.32(W) x49.56(H)	mm
	LCD active area	36.72(W) x48.96(H)	mm
	Display format	240 x3 RGB x320	dots
	Color configuration	RGB stripes	-
	Dot pitch	115.5(RGB)(W) x 115.5(H)	um
Weight		TBD	grams

4. Interface signals

Figure 1: Outline Drawing

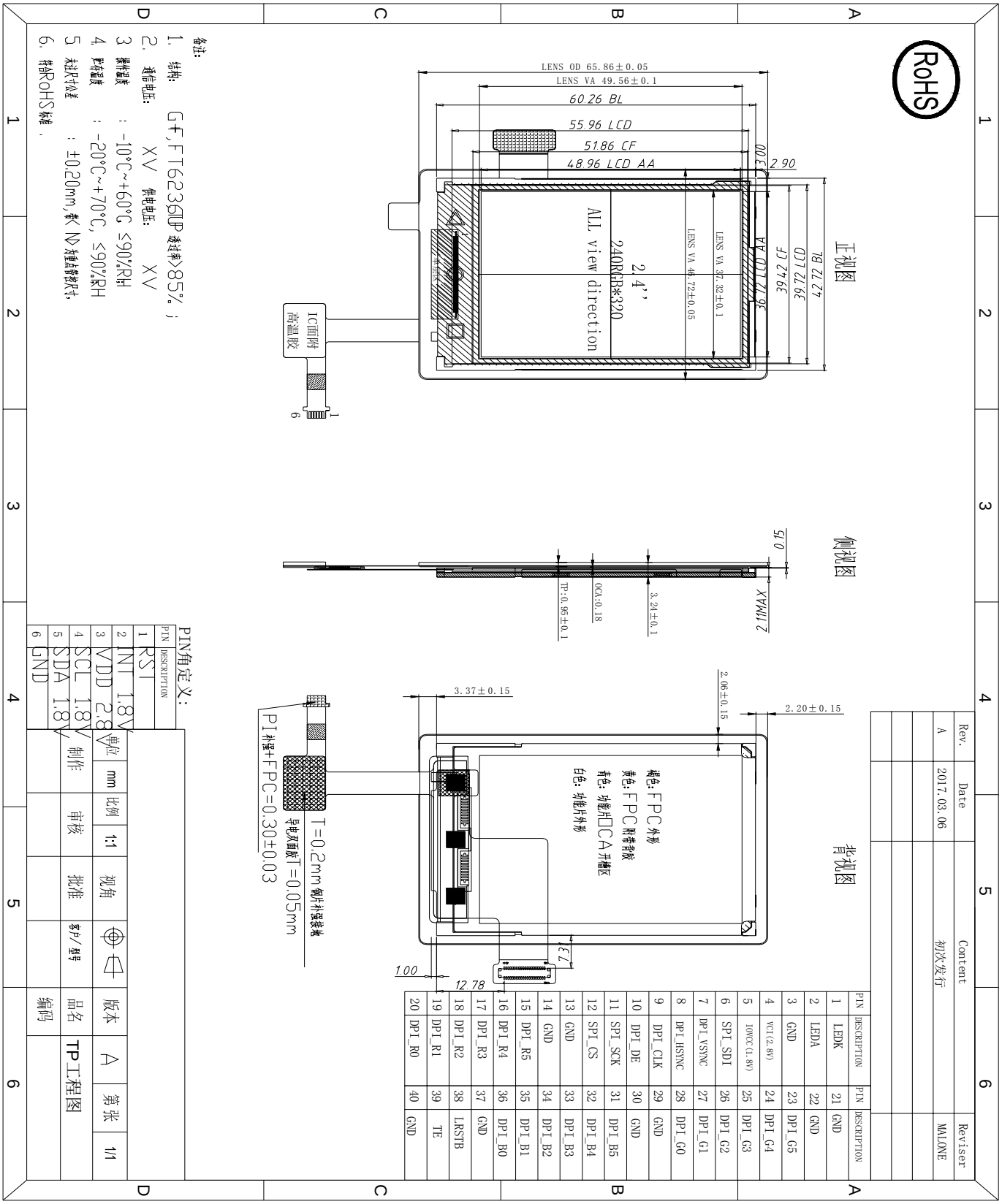


Table 2: LCM Pin assignment

Pin No.	Symbol	Description
1	LEDK	POWER SUPPLY- FOR BACKLIGHT CATHODE
2	LEDA	POWER SUPPLY+ FOR BACKLIGHT ANODE
3	GND	GND
4	VCI	POWER SUPPLY（2.8V）
5	IOVCC	POWER SUPPLY（1.8V/2.8V）
6	SDA	DATA IS LATCHED ON THE RISING EDGE OF THE SCL SIGNAL
7	VSYNC	Frame synchronizing signal
8	HSYNC	Line synchronizing signal
9	DCLK	Dot clock signal
10	DE	Data enable signal
11	SCL	serial interface clock.
12	CS	CHIP SELECT
13	GND	GND
14	GND	GND
15-20	R0-R7	RED DATA.
21-22	GND	GND
23-28	G0-G7	GREEN DATA.
29-30	GND	GND
31-36	B0-B7	BULE DATA.
37	GND	GND
38	RESET	RESET PIN
39	TE	Tearing effect signal pin
40	GND	GND

Table 3:Touch Pin assignment。

NO:	SYMBOL	I/O	FUNCTION
1	RST	O	Touch panel reset
2	INT	O	Touch panel interrupt output
3	VDD	P	Touch panel I/O PWR supply
4	SCL	I/O	Touch panel I2C clock
5	SDA	I/O	Touch panel I2C data
6	GND	P	Ground

5. Absolute Maximum Ratings

5.1 LCM Electrical Maximum Ratings – for IC Only

Table 3: Electrical Maximum Ratings – for IC

Parameter	Symbol	Min.	Max.	Unit	Note
Power supply voltage (VDD)	VDD	-0.3	+4.0	V	1
Power supply voltage (IOVCC)	IOVCC	-0.3	+3.6	V	1

Note:

1.IOVCC,VCI, GND must be maintained.

2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

5.2 Touch Maximum Ratings – for IC Only

Ltem 项目		Symdol	min	Typ.	Max	Unit	Remarks 备注
Lnput PowerVoltage 输入电源电压		VDD	2.8	3.3	3.3	V	
lnputSignalVoltage 输入信号电压	H Level	VlH	2.8	3.3	3.3	V	
	L Level	VlL		0			
Supply Current 电源电流		*lDD				MA	

5.3 LCM Environmental Condition

Table 4

Item	Operating temperature (Topr)		Storage temperature (Tstg) (Note 1)		Remark
	Min.	Max.	Min.	Max.	
Ambient temperature	-20°C	+70°C	-30°C	+80°C	Dry
Humidity (Note 1)	80% max. RH for Ta 40C < 50% RH for 40C < Ta Maximum operating temperature				No condensation

Note 1: Product cannot sustain at extreme storage conditions for long time.

5.4 Touch **Environmental Condition**

项目 Item	规格 Specification	备注 Unit
工作温湿度范围 Operating temperature&Humidity	-10℃~+60℃, <90%RH	无结露 Non condensing
储存温度湿度范围 Storage temperature&Humidity	-20℃~+70℃, <90%RH	无结露 Non condensing

6. Electrical Specifications

6.1 LCM Typical Electrical Characteristics

At Ta = 25 °C, VCI = 2.6V to 3.3V, IOVCC= 1.65V to 3.3V GND=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (analog)	VCI-GND		2.6	2.8	3.3	V
Supply voltage (logic)	IOVDD-GND		1.65	1.8	3.3	V
Supply current (Logic & LCD)	ICC	VCI=2.8V	10	15	20	mA
Supply voltage of white LED backlight	VLED =V(BL+)-V(BL-)	Forward current =60 mA Number of LED dies = 4	3.0	3.2	3.4	V
Luminance (on the module surface)			-	TBD	-	cd/m^2

6.2 Touch Electrical Characteristics

项目 Item	规格 Specification				备注 Remark
触控点 Touch point	5-Points				触控点同步侦测数量 The numder of touch points simultaneouslydetect
电压范围 Voltage range	Min	TYP	Max	Unit	
	2.5	3.0	3.6	V	
电流 Current range				mA	
绝缘阻抗 Lnsulation resistance	≥20M@25V(直流) ≥20M@25V(DC)				使用高压测试机进行测试或使用绝缘(25V)测试头按压于引线未端进行测试. Usehigh-pressuretesting machingor

		useinsulationmeter(25V)to test the endofFPC
线性 Linearity	≤3.0%	用线性测试机进行测试. Use linear Tester.
触电抖动时间 Chatteering Time	≤25ms	/
抗干扰能力	电源、LCD、温度	IC贴上高温胶,距离电源、LCD 2-3cm

6.3 Touch **Mechanical characteristics**

项目 Item	规格 Specification		备注 Remark
输入方式 Lnput method	手指 Finger or exclusive pen		
操作寿命 Operation life	敲击寿命 Tapping duradility	≥1 百万次 ≥ 1milliontimes	试验可能造成产品表面轻微的划伤,但功能保持不变. Test may cause suse surface slightscratch yet the function staysintact.
	笔画寿命 Pensliding duradilty	≥2 亿次 ≥100.000times	
表面硬度 Hardness	6H		500g 压力测试 Pressure 500gf test
玻璃硬度	强化玻璃 0.55mm，可耐 9g 钢球最少 30mm 的冲击。		

7. Optical Characteristics

7.1 LCM Optical Characteristics

Table 7: Optical specifications

Items	Symbol	Condition	Specifications			Unit	Note
			Min.	Typ.	Max.		
Contrast Ratio	CR		-	500	-	-	
Response Time	T_R		-	10	20	ms	
	T_F		-	15	20	ms	

Chromaticity	Red	X_R		0.604	0.634	0.664	-	
		Y_R		0.298	0.328	0.358	-	
	Green	X_G		0.264	0.294	0.324	-	
		Y_G		0.547	0.577	0.607	-	
	Blue	X_B		0.107	0.137	0.167	-	
		Y_B		0.104	0.134	0.164	-	
	White	X_W		0.272	0.302	0.332	-	
		Y_W		0.305	0.335	0.365	-	
Viewing angle	Hor.	ϕ1(3 o'clock)	Center CR≥10	-	80	-	deg.	
		ϕ2(9 o'clock)		-	80	-		
	Ver.	θ2(12 o'clock)		-	80	-		
		θ1(6 o'clock)		-	80	-		
NTSC ratio					4.8		%	

Note 1: Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63

L0: Luminance of gray level 0

CR = CR (10)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note 5.

Note 2: Definition of Response Time (TR, TF):

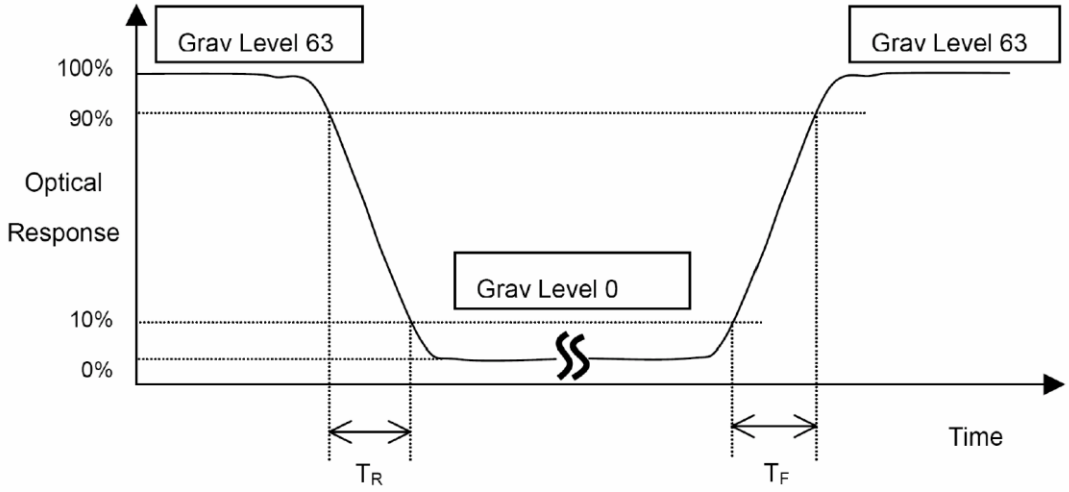


Figure 3

Note 3: Viewing Angle

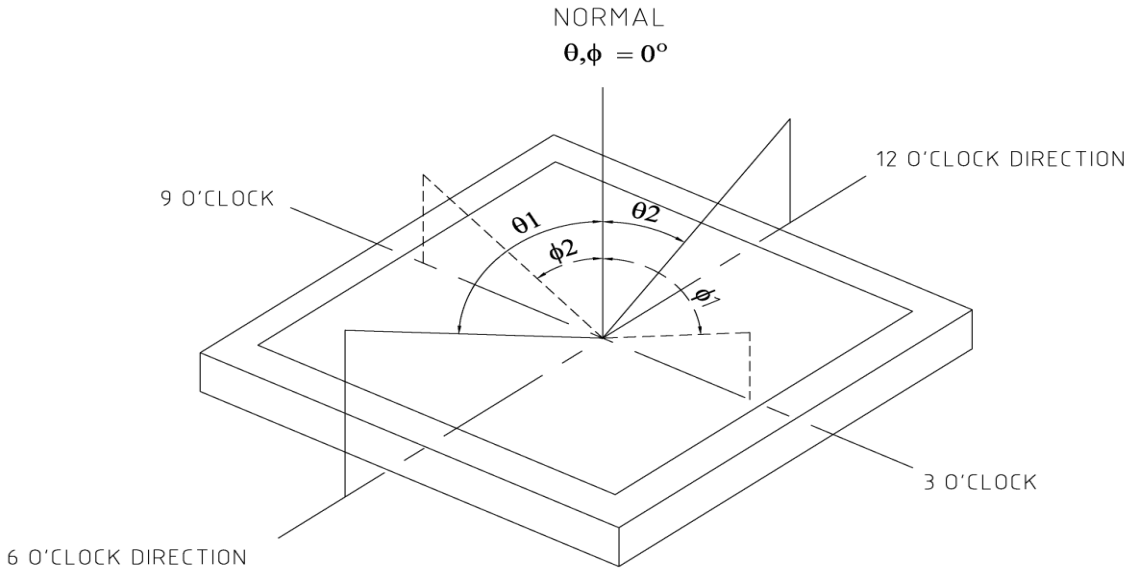


Figure 4

The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

Note 4: Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

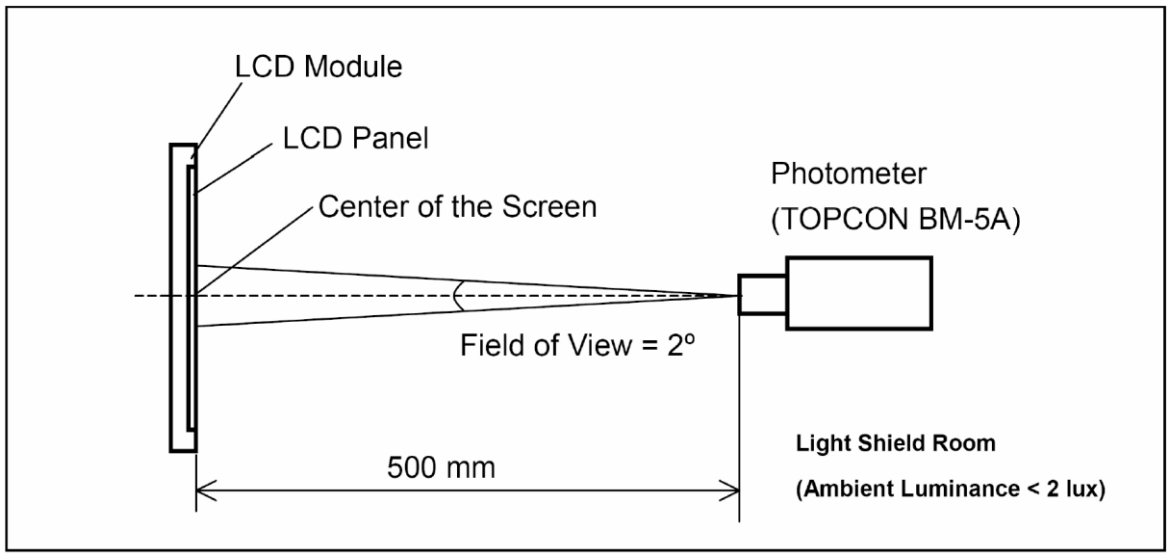


Figure 5

7.2 Touch Optical Characteristics

8. Timing Characteristics

项目 Item	规格 Specification	备注 Remark
透明度 Transparency	≥80%	白光测试

8.1 RGB Interface Timing Characteristics of IC

Table 8: Normal Write Mode (VCC = IOVCC=2.4~3.3V)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time (write cycle)	100	-	-	ns
t_{cycle}	Clock Cycle Time (read cycle)	1000	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Data Setup Time	5	-	-	ns
t_{DHW}	Data Hold Time	5	-	-	ns
t_{ACC}	Data Access Time	250	-	-	ns
t_{OH}	Output Hold time	100	-	-	ns
$PWCS_L$	Pulse Width /CS low (write cycle)	50	-	-	ns
$PWCS_H$	Pulse Width /CS high (write cycle)	50	-	-	ns
$PWCS_L$	Pulse Width /CS low (read cycle)	500	-	-	ns
$PWCS_H$	Pulse Width /CS high (read cycle)	500	-	-	ns
t_R	Rise time	-	-	4	ns
t_F	Fall time	-	-	4	ns

The timing chart of RGB interface DE mode is shown as follows.

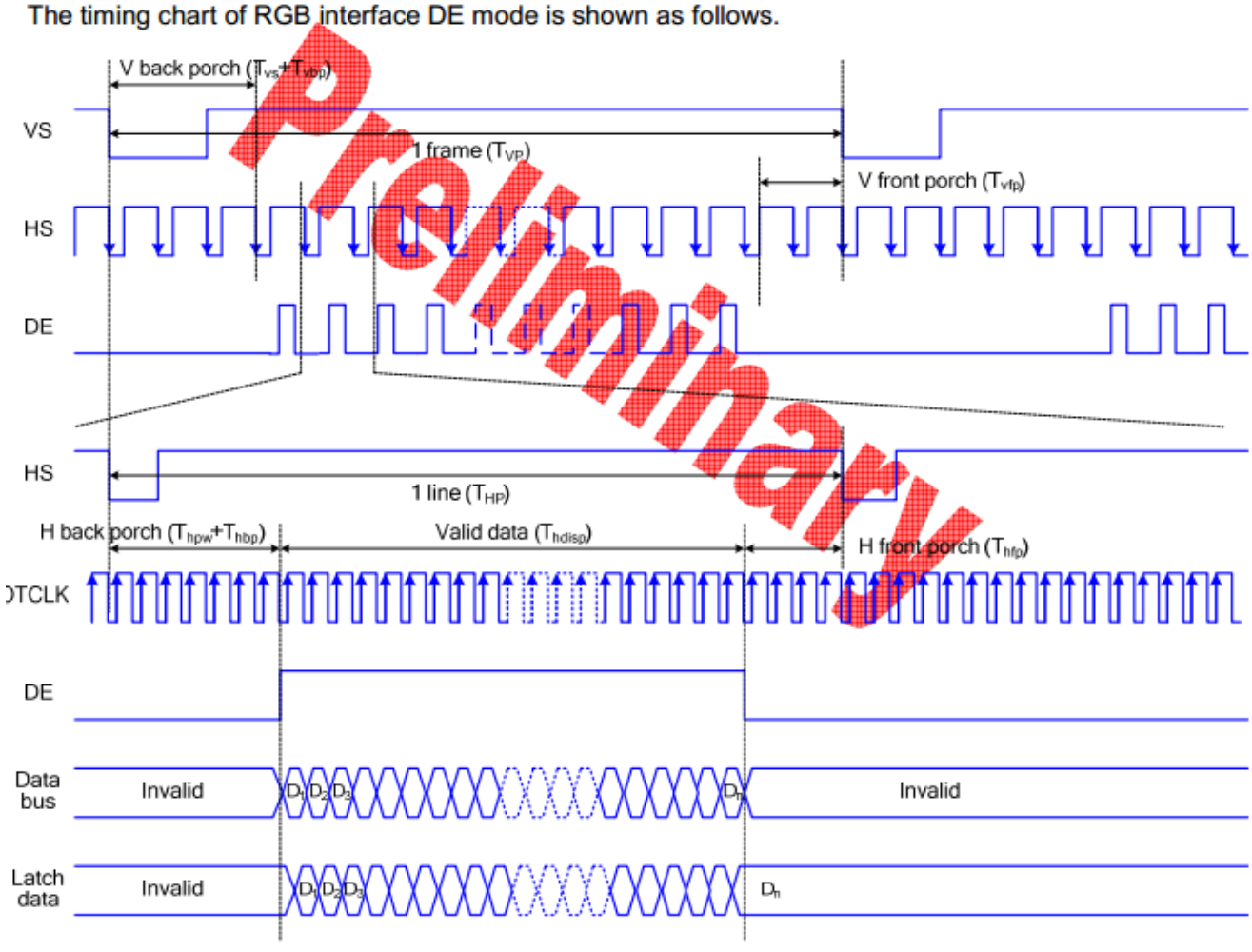


Figure 7. RGB Timing

8.2 Reset Operation of IC

Table 9: Reset Timing Characteristics (VCC = IOVCC=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.
Reset low-level width	tRES	ms	1	-	-
Reset rise time	trRES	μs	-	-	10

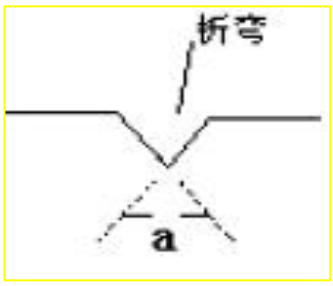
Figure 8: Reset Timing

9. Reliability Test Item

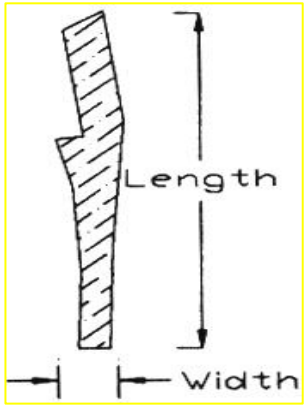
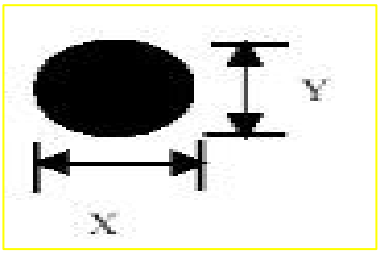
Test Item	Sample Type	Test Condition	Test result determinant gist
High temperature storage	Normal temperature	70±3℃;96H	the inspection of appearance and function character.
	Wide temperature	80±3℃;96H	
Low temperature storage	Normal temperature	-20±3℃;120H	
	Wide temperature	-30±3℃;120H	
High temperature /humidity storage	Normal temperature	50℃±3℃,90%±3%RH;96H	
	Wide temperature	60℃±3℃,90%±3%RH;96H	
High temperature operation	Normal temperature	60±3℃;96H	no objection of the function character; no fatal objection of the appearance.
	Wide temperature	70±3℃;96H	
Low temperature operation	Normal temperature	0±3℃;96H	
	Wide temperature	-20±3℃;96H	
High temperature /humidity operation	Normal temperature	40℃±3℃,90%±3%RH;96H	
	Wide temperature	50℃±3℃,90%±3%RH;96H	
Temperature Shock	Normal temperature	-20±3℃,30min→70±3℃,30 min;10cycle	inspect the objections appearance、function & the whole structure
	Wide temperature	-30±3℃,30min 80±3,30min;10cycle	The inspection of appearance、function & the whole structure

9.1 特殊检验要求：

检查项目　　可接受标准　　备注

背光	1.无背光不接受 2.亮度，均匀度及功耗须在 SPEC 之内 3.颜色坐标需在规格内或依据限度 4.非背光框变形的漏光在玻璃外缘可以接受	目视检查/放大镜
铁壳	任何明显可见的损坏、变形和其它铁壳上有锡渣不可接受	
FPC	1.变形和折痕标准如图所示，两条折痕的角度不能超过90°C 2.补强板裂、破损、外来材料和气泡的面积,如果超过补强板的1/5 不能接受 3.金手指部位有明显划伤、污点和外来细小指针状的异物都不可接受 4.金手指氧化或者电镀不良不可以接受 5. pad 脱落或者断裂不可接受	

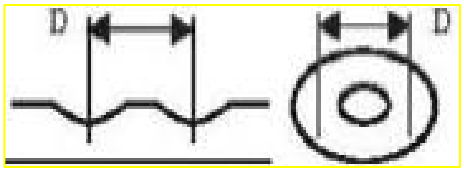
9.2 TFT&触摸屏检查标准如下表:

检查项目	Accesseble standard			备注
1.线状缺陷(黑/白线等)	length (mm)	wide (mm)	Accesseble QTY	
	----	W ≤ 0.05	access	
	L ≤ 5	0.05 < W ≤ 0.1	1	
2.划伤	length (mm)	wide (mm)	Accesseble QTY	
	----	W ≤ 0.05	access	
	L ≤ 5	0.05 < W ≤ 0.1	1	
3.点状缺陷	size(mm)		Accesseble QTY	
	D≤0.10		access	
	0.10<D≤0.20		2	
	0.2<D≤0.25		1	
	D>0.25		0	

D= (长边直径 X+短边直径 Y)/2

4. TP 鱼眼、凹点、气泡

size(mm)	Accesseble QTY
D≤0.20	access
0.20<D≤0.30	6
0.3<D≤0.5	2
D>0.5	0



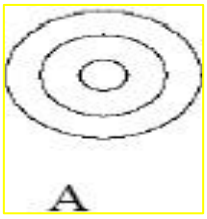
5. 牛顿环检查

A

均匀牛顿环(图 A)

1. 如牛顿环面积大小超过 T/P 整个面积的1/4，则不可接受.

2. 在莹光灯下，如牛顿环小于 T/P 的 1/4 且不影响显示字体效果，则可接受

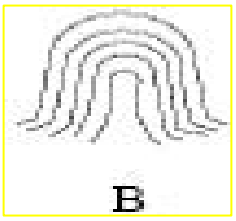


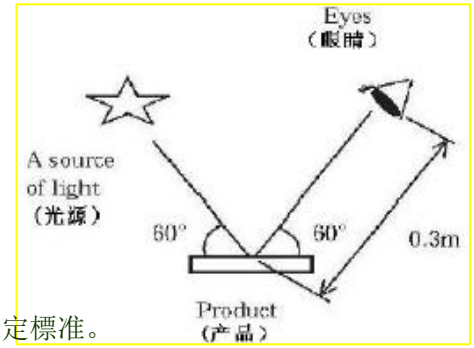
B

不均匀牛顿环(图 B)

1. 在无莹光灯下，如牛顿环大于 7mm，则不可接受

2. 在莹光灯下，无论大小只要造成文字失真或直线变形，判定 NG



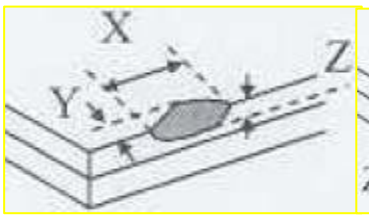


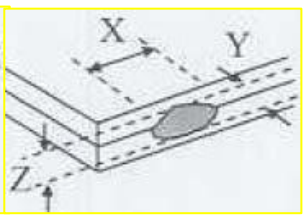
备注：檢驗時要撕起保護膜，检查规格参照点状、線状异物混入判定標准。

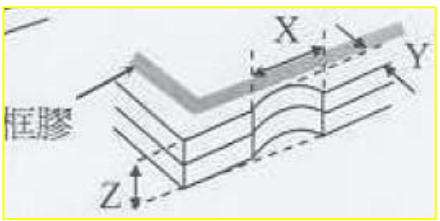
以上的点缺陷距离必须大于 5mm &点、线缺陷相加后可接受数量之总和为 5

代号说明：X:崩裂长度 Y：崩裂宽度 Z：崩裂厚度 a:LCD 边长 D:端子长度 t:玻璃厚度

6. 表面及中间崩裂



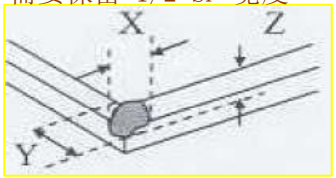




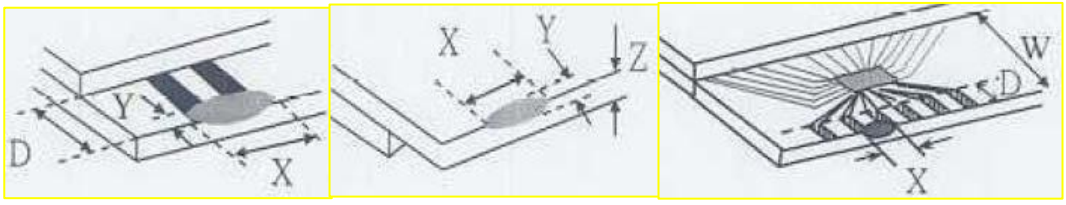
Z	X	Y
Z≤1/2t	X≤a	不可以进入 SP 内缘
Z≤1/2t	X≤a	需要保留 1/2 SP 宽度

7. 角落崩裂

Z	X	Y
Z≤1/2t	X≤1/8a	不可以进入 SP 内缘
Z≤1/2t	X≤1/8a	需要保留 1/2 SP 宽度



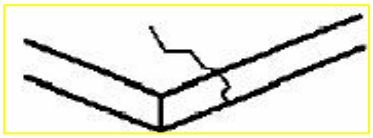
8 电极端子区崩裂



	X	Y	Z
正面	X≤1/5a	Y≤0.5mm	z≤t
背面	X≤1/5a	Y≤0.5mm	z≤1/2t

以上崩裂超过一处时间，X 是所有崩裂长度的总和；正面的崩裂不可以进入视区。
每一单处电极的崩裂宽度不超过原电极宽度的 1/4

9.裂



任何有延伸趋势的裂痕都不可接受

偏光片、反射片与玻璃不良	玻璃、反射片与偏光片的破损及划伤遵照点状缺陷和线状缺陷标准	Minor
	不应有贴反、未贴、贴错等现象	
	尺寸应符合规范,不应无保护膜	Minor
	贴歪的偏光片应该显现全部的 SP 框形	
	缺行、缺列、串扰、乱码不可以接受	
	色度、灰度、亮度、均匀度和对比度失常（对比 Golden Sample 和 Spec.）	
	不显示的像素中异常点/线（工艺形成）遵照点状缺陷和线状缺陷标准	
	显示偏、斜（S）遵照下表：	
有效可视面不良(电测)	S<0.3mm 可接受	
	0.3mm≤S<0.5mm 缺陷级别Minor	Major
	S≥0.5mm 缺陷级别Major	
	在批处理中如果有两种或两种以上的偏/斜同时存在，遵照最高缺陷级别	
	表面上不能有软布轻擦不去或气枪吹不干净的异物（包括布丝、灰尘、焊锡球、粘胶、阴影等）依据点线规格判定	
	条彩，错开，流迹，玻璃漏光依据彩色画面判定	
	视角错误不可以接受；显示看见水波纹不可以接受；抖面 不可以接受	
漏失	1. 视区内发现不规则状黑团，亮团（挤压玻璃会移动）不可以接受	Major
	2. 空穴回弹：敲击气泡不可以接受	
COG 区	1.IC 处不可有破损、划伤	
	2.封口胶进入视区不可以接受，	
	3.封口胶脱落，如果渗胶深度达到要求，可以接受。	minor
	4.表面的涂布胶位置依据作业文件要求，高度不可以超过上偏光片，必须完全覆盖端子的 ITO 线路	

如果上述不良不发生在可视区域,标准可以适当放松

9.3 TFT 特别检查:

检查项目	可接受标准	图表
像素缺陷的定义	像素/3 个元素(R+G+B)	

点/1 个元素(R/G/B)

亮点：与周围邻近 pixel 对比较亮的点为亮点，超过一个 sub pixel 面积的 1/2时计为一个亮点.颜色有红、绿、蓝三种,亮点可在 R、G、B 三个画面中的两个画面可视，在全白画面不可视；
暗点：与周围邻近 pixel 对比较暗的点为暗点，超过一个 sub pixel 面积的 1/2 时计为一个暗点.颜色为暗黑色，暗点在 R、G、B 三个画面中的一个画面可视，在全白画面可视；
相邻点的定义:2 个或 3 个点连续元素点(R+G/G+B/B+R/R+G+B).

		失效模式	可接受判定标准	
			点的形式	数量
点缺陷判定标准	目视/测量卡	亮点	任何(红,蓝,绿)	1 个并不超点状大小上限
			2 个连接点	0
			暗点	2
		暗点	2 个连接点	1
			>=3 个相邻的点	0

10. Suggestions for using LCD modules

10.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated ,clean it with soft cloth. If the LCM is severely contaminated , use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer . The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don’t disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
   - Be sure to ground the body when handling the LCD modules.
   - Tools required for assembling, such as soldering irons, must be properly grounded.
   - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
   - The LCD module is coated with a film to protect the display surface. Exercise care when peeling

off this protective film since static electricity may be generated.

9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

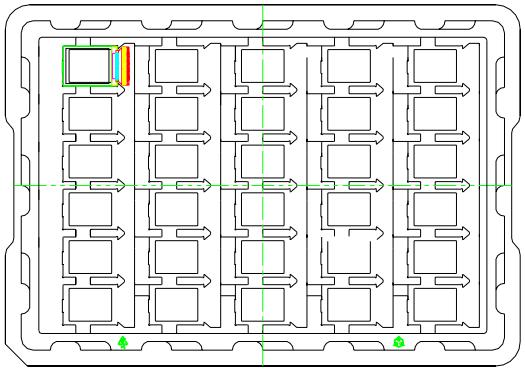
10.2 Storage

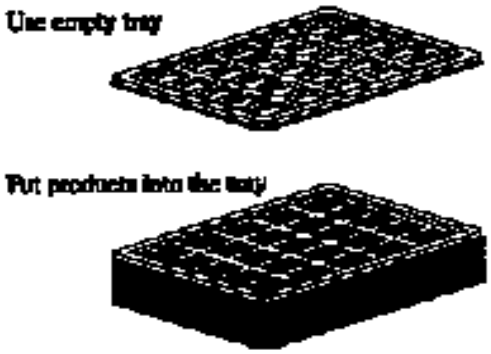
1. Store in an ambient temperature of 5 to 45 错误！未找到引用源。C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

11. Packing (Reference only)

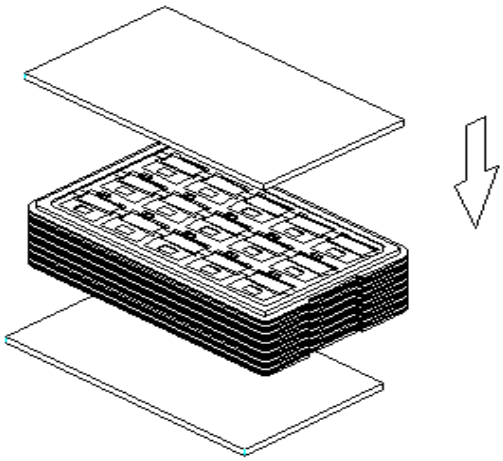
Packing Method

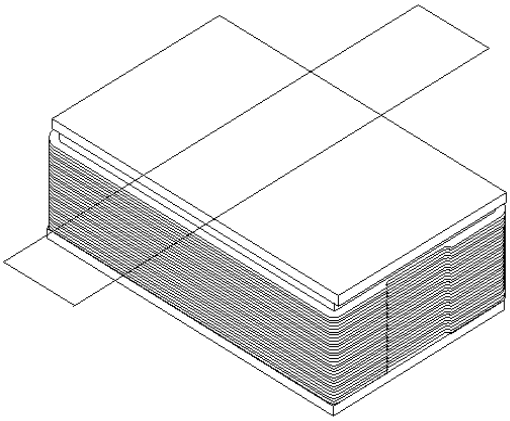
(1) (2)



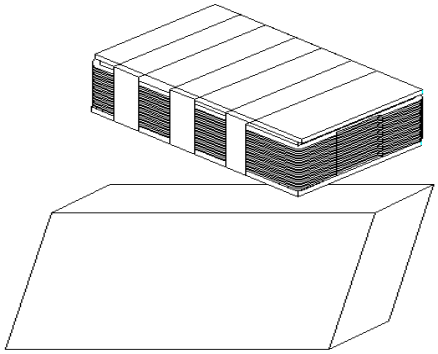


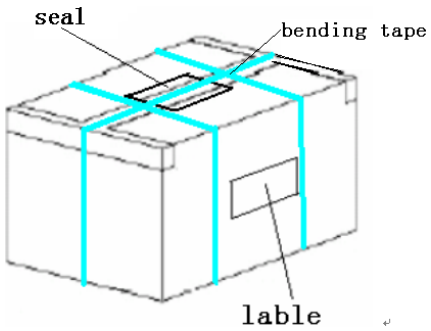
(3) (4)





(5) (6)





1. Put module into tray cavity :
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above:
4. Fix the cardboard to the tray stack with adhesive tape:
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

- END -